

Field Measurements and Data Collection

Goals:

The goal of this field campaign is to collect forest structure parameter to generate and improve maps of above-ground biomass by combining field measurements with satellite imagery.

The acquisition of new field measurements using a standardized methodology at the sub-national, national and international level will provide partner-country institutions (NGOs, Ministry, etc.) with the opportunity to better integrate the results from various surveys and also greatly expand their knowledge on the integration of forest measurements with remotely sensed data sets. This knowledge is fundamental to any monitoring strategy that incorporates remote sensing imagery for carbon stocks estimation.

Measurements Requirements:

The field campaign is focused primarily on the measurement of stem diameters (diameter at breast height; DBH) for all live trees ≥ 5 cm DBH occurring within a 40 meter x 40 meter sampling unit (plot) (Figure 1).

Plot location

The center coordinates (longitude/ latitude) of each plot should be located with a hand-held GPS together with existing auxiliary data such as aerial photographs, topographic maps, and/or very high resolution satellite images. The GPS receiver should be set to work using the Geographic (latitude/longitude) coordinate system and the WGS 84 datum. Available maps or imagery should be used to identify land marks and reference points that can be used to facilitate navigation to each plot center.

Plot delineation

Once the center of the plot has been reached, the exact location (latitude/longitude) should be recorded on the plot form. The sample plot should then be laid out. Using a compass and a metric fiberglass tape:

- (1) Establish a line running 28 meters due north. When the 28 meter mark is reached, stop and flag the exact location. This is the vertex (A) of the plot diagram shown in Figure 1.
- (2) Returning to the center of the plot, establish a line running 28 meters due south. When the 28 meter mark is reached, stop and flag the exact location. This is the vertex (C) of the plot diagram shown in Figure 1.
- (3) Returning to the center of the plot, establish a line running 28 meters due east. When the 28 meter mark is reached, stop and flag the exact location. This is the vertex (B) of the plot diagram shown in Figure 1.
- (4) Returning to the center of the plot, establish a line running 28 meters due west. When the 28 meter mark is reached, stop and flag the exact location. This is the vertex (D) of the plot diagram shown in Figure 1.

With flagging tape, rope, etc., mark the lines joining vertices A, B, C, and D. These lines represent the plot boundary.

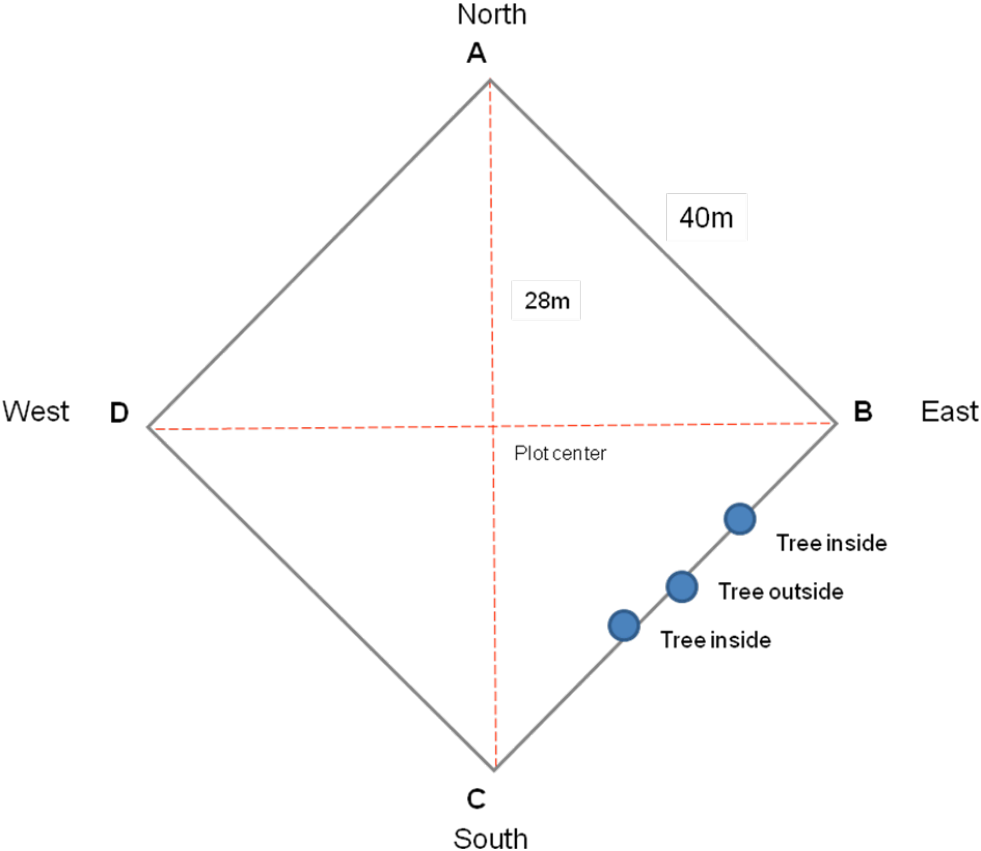


Figure 1. Diagram of plot layout (40-meter sides).

Tree DBH measurements

Within the plot, all alive trees with a diameter at breast height ≥ 5 cm DBH should be measured on the Field Data Collection Form (see Appendix I). Dead trees should not be measured. A tree should be considered inside the plot if the center of the stem falls within the 40 by 40 m² plot boundary (see Figure 1). If the center of a stem falls exactly on the plot boundary, it should be considered inside the plot and a measurement should be recorded.

Tree diameter is measured over bark, at 1.3 meters above the ground with few exceptions (see Appendix II). Diameter is measured with a diameter tape or a diameter caliper to the nearest centimeter. When using a diameter tape, make sure to use the proper side of the tape, i.e., the side that reports the diameter and not the circumference. To avoid accidentally measuring the same tree more than once, mark each tree with a loggers crayon (or some other method) after making each diameter measurement.

Tree height measurements

Within the plot, measure the DBH and height of the 3 tallest trees within a 25-meter radius of the plot center. Measure all tree heights using a clinometer (see Appendix III) or equivalent device.

Data Management

Make photocopies of all completed plot forms and mail the original forms to:

Dr. Alessandro Baccini,

The Woods Hole Research Center,

149 Woods Hole Road

Falmouth, Massachusetts, USA 02540

abaccini@whrc.org or biomass@whrc.org

Use the retained copies to enter the data into an Excel computer file. An Excel file template will be provided for your use.

Appendix I: Woods Hole Research Center – Field Data Collection Form

Plot ID: _____ Data collected by: _____ Page: _____ of: _____
 (yymmdd+UN country code+plot number) Data entered by: _____ Date: _____
 Example: 0811128001151803654_09 Country: _____
 1151803654_09 = REC_NDX + ' ' + SHOT_NUM

UN country codes: Cameroon 120; CAR 140; DRC 180; Gabon 266; Kenya 404; Mozambique 508; ROC 178; Tanzania 834; Uganda 800; Zambia 894

GPS coordinates: _____ Latitude _____ Longitude _____
 (While standing at the plot center, record the GPS coordinates in decimal degrees. Be sure to include all digits after the decimal point.)

Estimated distance to road: _____ km Estimated distance to water _____ km Estimated distance to settlement _____ km

Land cover/Land use Description (see Appendix IV for codes to be entered in each of the following columns):

Vegetation	Habitat	Human Land Cover/Use	Topo-graphy	Water Regime	Soil	Canopy Cover	Dominance Canopy	Canopy Height	Dominance Understory	Understory Type

Evidence of logging: Y / N Describe: _____
 Evidence of fire/burning: Y / N Describe: _____
 Evidence of grazing: Y / N Describe: _____

General description & notable features:

DBH and height of the 3 tallest trees within a 25-m radius of the plot center: (1) DBH _____; _____ m (2) DBH _____; _____ m (3) DBH _____; _____ m

Plot photos	While standing at the plot center, take one photo while facing each of the following directions. Record the photo ID number assigned by the camera. Each photo should include the white board labeled with the plot ID (e.g., 081112800001)				
Direction	North	South	East	West	Up
Photo ID					

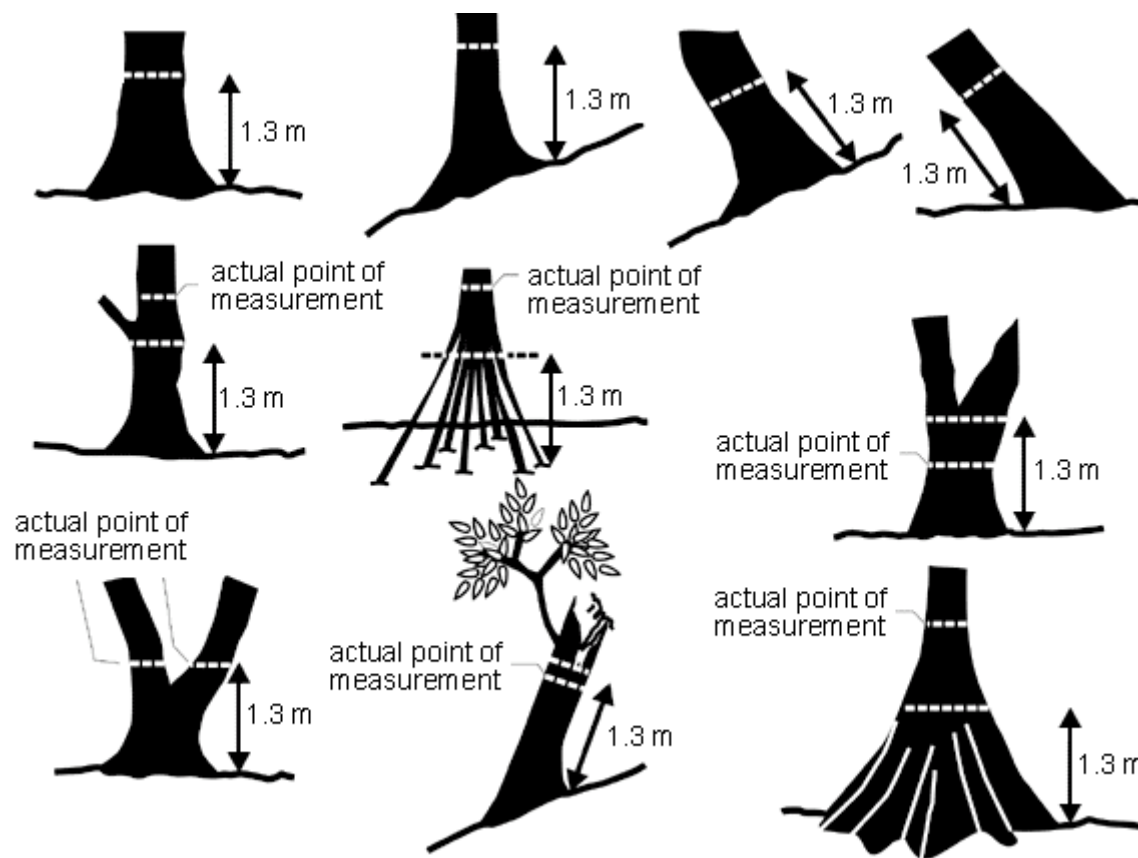
Plot ID: _____
 (yymmdd+UN country code+plot number)
 Example: 0811122561151803654_09
 1151803654_09 = REC_NDX + ' ' + SHOT_NUM

Data collected by: _____
 Data entered by: _____
 Country: _____

Page: _____ of: _____
 Date: _____

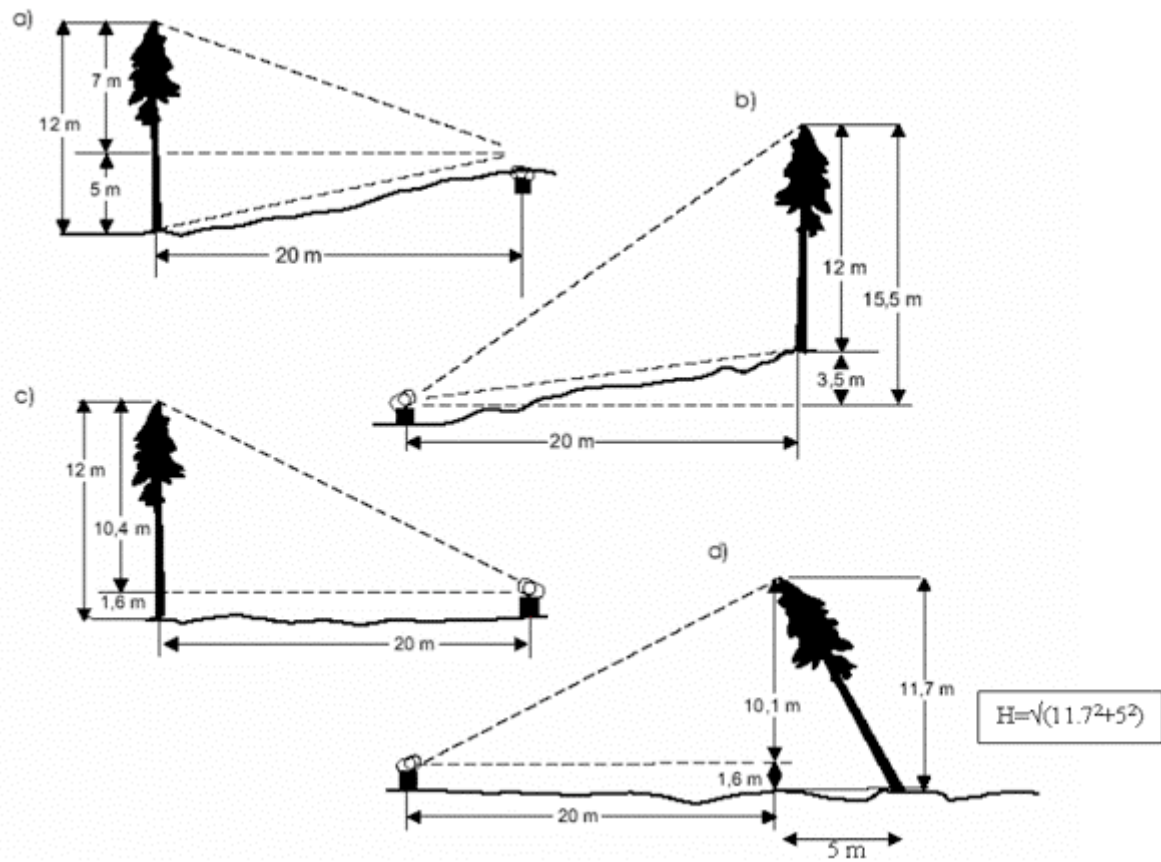
Tree number	DBH (cm)	Tree number	DBH (cm)	Tree number	DBH (cm)	Tree number	DBH (cm)	Tree number	DBH (cm)	Tree number	DBH (cm)	Tree number	DBH (cm)
1		28		55		82		109		136		163	
2		29		56		83		110		137		164	
3		30		57		84		111		138		165	
4		31		58		85		112		139		166	
5		32		59		86		123		140		167	
6		33		60		87		114		141		168	
7		34		61		88		115		142		169	
8		35		62		89		116		143		170	
9		36		63		90		117		144		171	
10		37		64		91		118		145		172	
11		38		65		92		119		146		173	
12		39		66		93		120		147		174	
13		40		67		94		121		148		175	
14		41		68		95		122		149		176	
15		42		69		96		123		150		177	
16		42		70		97		124		151		178	
17		44		71		98		125		152		179	
18		45		72		99		126		153		180	
19		46		73		100		127		154		181	
20		47		74		101		128		155		182	
21		48		75		102		129		156		183	
22		49		76		103		130		157		184	
23		50		77		104		131		158		185	
24		51		78		105		132		159		186	
25		52		79		106		133		160		187	
26		53		80		107		134		161		188	
27		54		81		108		135		162		189	

Appendix II



How to measure DBH under special conditions (Dallmeier, 1992).

Appendix III



For the correct use of the SUUNTO clinometer see the SUUNTO USER'S GUIDE

Appendix IV: Codes used to complete the Land cover/Land use Description portion of plot form

1. Vegetation

Forest	FOR
Woodland	WOOD
Shrub/Bushland	SHRB
Grassland	GRS
Forested Wetland (Swamp)	SWMP
Nonforested Wetland	WET (e.g. Papyrus, Phragmites, etc.)
Clearing	CLR
Bamboo	BMB
Bare soil	BRS (e.g. beach, dry salt flat, etc.)
Bare rock	BRR
Other	OTR

2. Habitat

Closed Tropical High Forest (>50% canopy closure, trees taller than 15m)	THFC
Open Tropical High Forest (<50% canopy closure, trees taller than 15m)	THFO
Closed young/secondary forest (>50% canopy closure, trees shorter than 15m)	SFC
Open young/secondary forest (<50% canopy closure, trees shorter than 15m)	SFO
Woodland (Trees widely spread and with grass below/between them)	WOD
Shrub/bushland (few trees but dense woody growth)	SHRB
Grassland (greater than 20m radius area of grassland with no trees)	GRSL
Montane grassland (greater than 20m radius area of grassland with no trees)	GRSH
Swamp (Forest where the soil is obviously waterlogged at certain times of year)	SWMP
Fern cover over a radius of 20 metres circle.	FERN
Pure stands of bamboo	BMBP
Bamboo mixed with forest	BMBM
Bamboo mixed with grassland	BMBGRS
Other (describe)	OTR

3. Human Land Cover/Land Use

Cultivation with Tree crops	CTR
Cultivation with Herbaceous crops	CHR
Mixed Cropping	CMIX
Cultivation with Scattered Natural Vegetation	CSC
Tree Plantation	PLNT
Mining	MINE
Logging	LOG
Road	ROAD
Foot path	PATH
Rail	RAIL
Bridge	BRG
Intersection	INTER
Residential - Dense (Village/Town)	RESDEN
Residential - Scattered Household	RESSC
Bare soil	BRS
Other	OTR

4. Topography

Plain	PLN
Steep slope	SSLP
Valley bottom/Riverine	VAL
Crest/ hilltop	CRST

5. Water regime

Dry ground	DGRND
Permanently inundated	INUNP
Seasonally inundated	INUNS
Other	OTR

6. Soil

Deep soil	DSOIL
Shallow soil (over rock)	SSOIL
Rock (no soil)	RCK
Other	OTR

7. Canopy cover

No trees	0
Very open (1-15%)	1
Open (15-65%)	2
Closed (>65%)	3

8. Dominance canopy

Mixed	MI
Dominance (monospecific)	MO
Undefined	UN
None	None

9. Canopy tree height

No canopy	0
Low <10m	1
Medium 10-25m	2
High >25	3

10. Dominance understory

Mixed	MI
Dominance (monospecific)	MO
Undefined	UN

11. Understory type

Wood	WOOD
Palm	PALM
Non-woody, grass	GRS
Non-woody, fern	FERN
Non-woody, shrub	SHRB
Woody liana	WLI
Herbaceous liana	HLI
Non-woody undefined	UN
Other	OTR